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REHABILITATION PROGRAM OF HOROLOGICAL INSTITUTE

A meeting was held at the Chamber of Commerce of the State of New York, 65 Liberty St., New York, N. Y., on August 26, to discuss the rehabilitation of war veterans in the field of watchmaking. This was a preliminary meeting looking toward the adoption of a definite program of cooperation between the Horological Institute of America, the horological schools, the State educational boards, the manufacturers of watches, and the U. S. Veterans' Administration.

Edward H. Hufnagel, Mt. Vernon, N. Y., treasurer of the Horological Institute, served as chairman of the meeting. The Bureau was represented by Ralph E. Gould, chief of the time section, and secretary of the Institute.

The meeting was opened by Mr. Hufnagel, who reviewed the conditions leading to the foundation of the Institute in 1921 by the National Research Council and described its objects and the progress it has made. Mr. Gould told of the cooperation existing between the Institute and the Bureau, explained the plan of certifying watchmakers that has been in operation for 22 years, and described the procedure followed in conducting these examinations.

The work of the Institute's educational committee was discussed by the committee's chairman, John J. Bowman, director of the Bowman Technical School. Howard L. Beehler, president of the Institute, outlined the rehabilitation program and explained in considerable detail a proposed course of instruction which would give disabled soldiers interested in watch repairing the necessary technical education.

Following these statements by Institute members, William A. Gilchrist of the Veterans' Administration described the needs and plans of the Administration in selecting and placing men in various approved schools. While no funds are available for preliminary development, he said that the schools which met the standards would receive tuition payment for each man placed. He stated, as his opinion, that it would be about 2 years before actual placement started, as the men first would have to be rehabilitated physically.

John W. Iseman, of the New York State Education Department, told of the course already established at Morrisville, and the proposed introduction of

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a horological course in the National Technical Institute in New York City.

Discussion of ways and means for financing the project led to offers of assistance from American watch manufacturers, provided that jewelers and watchmakers would likewise help. This would lead to the establishment of a fund in the Horological Institute for the preparation of a textbook and educational material to be used in the proposed instruction courses.

The need for more trained watch repairers is very great, the present supply and the annual number of graduates from the horological schools being far short of the demand. Many men trained as watch repairers have gone into instrument repair work and other mechanical occupations, or are serving in the armed forces, thus still further reducing the number of available trained men to care for the public's watches. It is hoped that through the cooperation of the various groups and an adequate program of instruction the number of trained men will be substantially increased, and that many partially disabled veterans will be furnished a means of earning a living at an honorable trade.

RAILWAY TRACK SCALE TESTING SERVICE TO BE CURTAILED

A major change has been made in the scope of the Bureau's railway track scale testing service. A number of considerations, some legalistic, others fiscal, were responsible for this decision, which has resulted in a curtailment of the field work. On September 1, when the itinerary of Testing Equipment No. 2 was completed, this equipment was laid up at the Master Scale Depot in Chicago. Only equipment No. 1 is being operated under a plan, the details of which have been worked out with the Association of American Railroads. This is based primarily upon a continuance by the Bureau of its fundamental service of calibrating master railway track scales. David V. Smith is carrying on this work with Equipment No. 1. H. Haig Russell, who has had charge of the equipment for many years, has been assigned to duty in the Weights and Measures Division of the Bureau at Washington.

LOW-GLOSS STANDARDS

The Bureau is prepared to issue calibrated low-gloss standards which may be used by manufacturers and representatives of the armed forces in testing the compliance of camouflage materials with specifications requiring them to have low gloss. Frequently in the examination of these materials according to present practices, measurements of identical materials, in different laboratories but on supposedly identical apparatus, have yielded results in serious disagreement. It is expected that these standards will help to eliminate such disagreements in measurements of the 60° specular gloss of camouflage materials.

These standards are calibrated on the scale defined by Procedure A of ASTM Tentative Method D523–41T for the specular gloss of paint finishes. Values for the specular gloss of the standards before correction for diffuse reflection are given. The standards are issued in sets, each consisting of: (1) Two ground gray-glass plaques, gloss about 6; (2) twenty sheets of resin-impregnated sandpaper, gloss about 2; (3) twenty sheets of white coated paper, gloss about 5; (4) twenty sheets of white coated paper, gloss about 13; and (5) twenty sheets of coated paper, gloss about 20.

Each set is supplied with a report giving the gloss of the glass panels at the time of issue and the estimated permanence of the gloss of the different panels.

The set of 82 low-gloss standard panels for use in the testing of camouflage materials (NBS Test fee schedule 4315z) costs $20.00.

LUMINOUS EFFICIENCY OF RADIANT ENERGY FROM THE SKY

In order to supply information requested, the Bureau has reduced and compared available data in the literature on the luminous efficiency of radiant energy from the blue sky. The best estimate that can be made is 100 lumens per watt. This estimate is based upon Moon's compilation of radiometric data for the sun (Parry Moon, Proposed Standard Solar-Radiation Curves for Engineering Use, J. Franklin Inst. 230, 583; 1940) combined with the Rayleigh law of scattering, which has been shown by Fowle (F. E. Fowle, The Atmospheric Scattering of Light, Smithsonian Misc. Coll. 69, No. 3; 1918) to apply to scattering of radiant energy by dry, dust-free air. From this law the luminous efficiency of the radiant energy scattered in the upper atmosphere is found to be 90.2 lumens per watt.

By penetration to the earth's surface this energy is changed in spectral distribution so as to be more efficient in

yielding light. The amount of this change is estimated by comparison with results computed by Moon for the unscattered solar energy (Tables IV and V), which indicate the following luminous efficiencies:

Air mass	Luminous efficiency of sunlight
	Lumens/watt
0	93.3
1	106
2	106
3	103
4	98.4
5	93.1

It is seen that as the sun's energy penetrates the atmosphere its luminous efficiency increases. Similarly, it is to be expected that the luminous efficiency of scattered radiant energy would increase from this cause and would vary between 90 and 106 lumens per watt, depending upon the dust and water-vapor content of the atmosphere. The round number, 100 lumens per watt, may well be representative of a typical cloud-free sky.

These estimates are fairly consistent with 138 measurements made by Kimball (Monthly Weather Rev. 52, 479; 1934) in Washington during the spring and sumer of 1924, which indicate the following luminous efficiencies of radiant energy from the sun and from the sun and sky incident on a horizontal surface:

Air mass	Luminous efficiency	
	Sun	Sun plus Sky
	Lumens/watt	*Lumens/watt*
1.1	109	108
1.5	106	104
2.0	104	100
2.5	103	98
3.0	102	97
3.5	101	96
4.0	100	96
4.5	99	96
5.0	98	96

ADHESIVENESS OF GUMMED PAPER TAPE

The Technical Association of the Pulp and Paper Industry has adopted a method for testing the adhesiveness of gummed paper tape used for sealing fiber containers, in which the Harnden-McLaurin machine is specified as the standard testing apparatus.

Investigation at the Bureau, in cooperation with a technical committee of the Gummed Industries Association, showed that if the apparatus complied with the TAPPI specification, it would serve the purpose satisfactorily.

The testing machine has two pivoted tables placed side by side with the adjacent parallel edges free to move in an arc when the force of a heavy pendulum is applied. The action of the tables simulates that of the closed flaps of a fiberboard shipping case after the pressure on them has been removed, allowing them to spring back to a partially open position. In making a test, a piece of kraft paper is fastened over the tables and is slit above the space between them. A piece of the gummed tape is fed from a roll over a moistening device, cut to the proper size, pressed over the slit in the kraft paper, and the tables are then tilted apart by releasing the pendulum. The resistance of the gum on the tape to the swing of the pendulum is indicated on a suitable scale. The method was described in the June 17, 1943, issue of the Paper Trade Journal.

FRICTION METER FOR FABRICS

The consumer of fabrics is interested in their smoothness, "sheen," "creep," and wear—characteristics that are associated with a fabric's frictional properties. New fibers and improved finishing agents developed for the production of fabrics more acceptable to the consumer require adequate means for evaluating their effectiveness. Accordingly, the American Society for Testing Materials and the Bureau, with the support of the textile industry, undertook to develop quantitative test methods and instruments for evaluating fabric finishes. One of these instruments, designed by Edwin C. Dreby, formerly research associate of the ASTM, is a friction meter for evaluating the coefficient of friction, a characteristic important in the "feel" of fabrics.

The coefficient of friction between the surfaces of two fabrics is a measure of resistance to slippage, a characteristic that is readily appreciated with the hands.

The friction meter combines ruggedness, sensitivity, and ease of operation—requirements which must be met by any instrument intended for routine textile testing. It can be used to determine the coefficients of friction of a wide variety of fabrics, to evaluate finishing agents, and to control processing with

respect to the frictional characteristics of fabrics. A detailed description will be published as RP1562 in the October Journal of Research.

STRUCTURE OF THE WOOL FIBER AS REVEALED BY THE ELECTRON MICROSCOPE

Wool fibers are not simple homogeneous structures but are made up of various parts and layers which become apparent under suitable conditions of observation. A growing wool hair is found to consist of a bulbous root situated below the surface of the skin and a filamentous shaft which extends above the skin surface. The shaft is made of dead cellular units that are arranged in three layers—an outer layer of scales (cuticle), a middle region called the cortex, and a central core of medulla. The medulla, which in the finest grades of wool is either very narrow or absent altogether, is not believed to contribute appreciably to the mechanical properties on which the usefulness of wool depends. Accordingly, attention has been directed largely to an understanding of the structure of the scale and cortical cells. The former are restricted to a thin layer which constitutes the outer surface of the fiber, whereas the latter, either in the form of a hollow or solid cylinder, depending on medullation, make up the bulk of the fiber.

The principal chemical constituent of wool is keratin, a protein consisting essentially of long polypeptide chains connected laterally by disulfide cross-linkages. Although both the cuticle and cortex appear to belong to this same general class of proteins, there is, nevertheless, evidence from studies with the optical microscope, and from a consideration of the behavior of these layers in swelling media, in dyes, and in other reagents, that there are certain differences between them. Since the dissimilarities in chemical composition of the cuticle and cortex are slight, it seems probable that the differences in behavior of these two regions may depend more on physical than on chemical properties. Accordingly, an investigation was undertaken by Charles W. Hock and Howard F. McMurdie to see whether differences in structure between the cuticle and cortex could be observed with the electron microscope—an instrument which, under suitable conditions, can resolve details of the order of magnitude of only one six millionth of an inch.

As reported in the October Journal of Research (RP1561), it was found that the cortical cells always showed a distinctly fibrous structure. Whereas with the optical microscope only fibrils were observed within the cortical cells, the higher resolving power of the electron microscope made possible the resolution of still finer microfibrils. The scale cells, on the other hand, showed little internal organization. This difference between the fibrous structure of the cortex and the nonfibrous or amorphous structure of the cuticle may be of fundamental importance in interpreting many of the properties of the fiber.

PHYSICAL TESTING OF LEATHER

The Chemistry of Leather Manufacture by John Arthur Wilson has long been the standard textbook of the industry. However, the latest edition was published in 1928, and a revision is therefore in order.

This revision is to take the form of a new book by the same title, which is being prepared by George D. McLaughlin of the Eisendrath Memorial Laboratory, and Prof. Edwin R. Theis of Lehigh University, with a chapter on physical testing methods by Warren E. Emley of the Bureau. Mr. Emley's chapter explains why physical testing methods have become increasingly important during the past few years. He then deals with the adequacy of sampling and with accepted methods of allowing for the water contained in the leather. Finally, 17 methods for testing leather are quoted from the work of the Technical Committee on Leather and Leather Products of the Federal Specifications Executive Committee and the Physical Testing Committee of the American Leather Chemists Association.

PURIFICATION, ASSAYING, AND ULTRAVIOLET ABSORPTION SPECTRUM OF POTASSIUM *p*-PHENOLSULFONATE

The test and control of the pH (acidity or alkalinity) of mildly alkaline solutions, such as boiler waters, require the use of chemicals called buffers or acidity regulators. At present, borates and secondary phosphates are used, but these do not cover completely the important pH range, 7 to 10. Potassium *p*-phenolsulfonate is a good buffer for the pH range of 8.4 to 9.2, and for spectrophotometric pH work with certain indicators. Since the purified product is not commercially available, and since quantitative tests for indicating its

purity have not been reported, an investigation covering the purification, assaying, and ultraviolet absorption spectra of potassium *p*-phenolsulfonate was undertaken by Elizabeth E. Sager, Marjorie R. Schooley, and S. F. Acree at the Bureau. Several recrystallizations from water of a commercial product gave a pure compound. A quantitative method of analysis by bromometric titration was developed, and it was found that 2 molecules of bromine react quantitatively with 1 molecule of *p*-phenolsulfonate in molar hydrochloric acid at 0° C within 5 minutes.

Ultraviolet absorption spectra were obtained for the impure compound and for the successive portions of the material subjected to six recrystallization steps. The spectrophotometric data agreed with the results of bromine analyses. The spectrophotometric curves obtained for the secondary salt of the *p*-phenolsulfonate are quite different from those for the primary salt. The absorption spectra of the compound in water and in diluted hydrochloric acid indicate that the sulfonate group is almost completely ionized.

The detailed report on this work will be published as RP1558 in the October Journal of Research.

pH VALUES OF PHENOLSULFONATE SOLUTIONS

A paper (RP1559) by Roger G. Bates, Gerda L. Siegel, and S. F. Acree in the October Journal of Research reports a series of pH values for solutions that can be used to improve the accuracy of pH measurement and control in alkaline media. The regulation of acidity in the slightly alkaline region has wide application in such diverse phases of science and industry as experimental biology and water treatment.

Thirty-nine buffer solutions composed of potassium *p*-phenolsulfonate, sodium hydroxide, and sodium chloride were studied at intervals of 5 degrees from 0° to 60° C. From electromotive-force measurements with these solutions, the second dissociation constant of *p*-phenolsulfonic acid and related thermodynamic quantities were computed and pH values assigned to each buffer.

All of these solutions have pH values between 8.6 and 9.0 at 25° C. The pH changes less than 0.001 unit for a 1-percent dilution of the buffer. The values decrease rather markedly with increase in temperature, however, and the temperature must be controlled within 1 degree if an accuracy of 0.01 unit in pH is desired.

X-RAY PATTERNS OF HYDRATED CALCIUM SILICATES

A paper entitled, Formation of Hydrated Calcium Silicates at Elevated Temperatures and Pressures, by E. P. Flint, H. F. McMurdie, and L. S. Wells was published in J. Research NBS 21, 617 (1938) RP1147. In that study various hydrated calcium silicates were formed by hydrothermal action. These were identified by X-ray powder patterns. The patterns made at the time were not sharp and accurate enough to justify publishing the data from them.

The X-ray powder patterns have been remade by H. F. McMurdie and E. P. Flint on more modern equipment, and the powder diffraction data on the following compounds are given in the October number of the Journal of Research (RP1560): $CaO.2SiO_2.2H_2O$, $2CaO.3SiO_2.2H_2O$, $4CaO.5SiO_2.5H_2O$, $5CaO.5SiO_2.H_2O$, $CaO.SiO_2.H_2O$, $2CaO.2SiO_2.3H_2O$, $3CaO.2SiO_2.1.5H_2O$, $3CaO.2SiO_2.3H_2O$, $5CaO.3SiO_2.3H_2O$, $2CaO.SiO_2.H_2O$, $2CaO.SiO_2.H_2O$ (second crystalline form), $10CaO.5SiO_2.6H_2O$, $6CaO.3SiO_2.2H_2O$, $3CaO.SiO_2.2H_2O$.

These data may be useful to those working on boiler scale, sand-lime brick and the hydration of portland cement.

POWER FACTOR MEASUREMENTS OF MICA

Mica is a strategic war material. An investigation of domestic sources by a number of Government agencies has been underway for several years. The best single electrical property indicative of the suitability of mica for use in radio condensers is its power factor, and this is readily determined by using a radio-frequency bridge and other commercial equipment normally available. Small metal foil electrodes are attached to the mica specimen forming a radio condenser, which is tested at 100 and 1,000 kc/s per second. The power factor in percent is indicated on a direct-reading scale.

E. L. Hall of the Bureau's radio section, who has made tests upon several hunderd mica specimens, has found that visual inspection is not a satisfactory means of selection for condenser use. Although mica that is clear or of a uniform color usually will be suitable for this purpose, many such samples have been found to have large power factors. Again, although mica samples with spots and stains are usually unsuitable for use in condensers, many spotted

samples have been found with low losses. Attempts to find a simpler method of selection have not been successful.

LAWRENCE A. WOOD, NEW CHIEF OF RUBBER SECTION

Lawrence A. Wood has recently been appointed chief of the Rubber Section of the Bureau. He succeeds A. T. McPherson, who became chief of the Organic and Fibrous Materials Division upon the resignation of Warren E. Emley (Tech. News Bul. No. 317, p. 72).

Dr. Wood has been a member of the staff of the Bureau for the past 8 years, and during that time has become recognized as an authority on the physical constants and properties of both natural and synthetic rubber. His Circular C427 on Synthetic Rubber, published in 1940, has been very widely circulated both in this country and abroad. He is the author of numerous other scientific papers dealing with the optical and thermodynamic properties of rubber, the crystallization of rubber, and related subjects. In 1938 Dr. Wood was appointed by the State Department one of two official delegates to represent the United States Government at the World Rubber Technology Conference held in London.

NEW AND REVISED PUBLICATIONS ISSUED DURING SEPTEMBER 1943

Journal of Research[2]

Journal of Research of the National Bureau of Standards, volume 31, number 3, September 1943 (RP1553 to RP1557, inclusive). Price 30 cents. Annual subscription, 12 issues, $3.50.

Research Papers[2]

[Reprints from the July 1943 Journal of Research]

RP1545. Width and spacing of tensile cracks in axially reinforced concrete cylinders. David Watstein and Douglas E. Parsons. Price 10 cents.

RP1546. Autographic load-elongation apparatus for fibers. Arnold M. Sookne and Henry A. Rutherford. Price 10 cents.

[2] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 50 cents a year; Journal of Research, $3.50 a year (to addresses in the United States and its possessions and in countries extending the franking privilege); other countries, 70 cents and $4.50, respectively.

Simplified Practice Recommendations[2]

R123–43. Carbonated beverage bottles. (Supersedes R123–30.) Price 5 cents.

R174–43. Cast-iron radiators. (Supersedes R174–41.) Price 5 cents.

Commercial Standards[2]

CS (E) 15–43. Men's pajamas. (Made from woven fabrics.) 2nd ed. Price 5 cents.

Technical News Bulletin[2]

Technical News Bulletin No. 317, September 1943. Price 5 cents. Annual subscription, 50 cents.

MIMEOGRAPHED MATERIAL

Letter Circulars

[Letter Circulars are prepared to answer specific inquiries addressed to the National Bureau of Standards and are sent only on request to persons having a definite need for the information. The Bureau cannot undertake to supply lists or complete sets of Letter Circulars or send copies automatically as issued.]

LC730. Color and legibility. (Supersedes LC351.)

LC731. Methods of using standard frequencies broadcast by radio. (Supersedes LC645.)

RECENT ARTICLES BY MEMBERS OF THE BUREAU'S STAFF PUBLISHED IN OUTSIDE JOURNALS[3]

Base metal alloys for oral restorations. George C. Paffenbarger, H. J. Caul, and George Dickson. J. Am. Dental Assn. (212 E. Superior St., Chicago, Ill.) 30, 852 (June 1943).

Weights and measures education in relation to the wartime emergency. C. F. Horton, Michigan Sealers Bul. (Michigan Assn. Weights and Measures Officials, Lansing, Mich.) 16, No. 1, 6 (August 1943).

Where measurements are in millionths. Hugh G. Boutell. Sterling Sparks (Sterling Grinding Wheel Division, Tiffin, Ohio) 2, No. 5, 12 (August 1943).

Final report of the O. S. A. subcommittee on the spacing of the Munsell colors. Sidney M. Newhall, Dorothy Nickerson and Deane B. Judd. J. Optical Soc. Am. (175 Fifth Ave., New

[3] These publications are not obtainable from the Government, unless otherwise stated. Requests should be sent direct to the publishers.

York, N. Y.) 33, No. 7, 385 (July 1943).

Data on chemicals for ceramic use. Alexander Silverman, George W. Morey, and Frederick D. Rossini, comprising Nat. Research Council Com. on "Chemical Data for Ceramics." Bulletin No. 107, National Research Council (Washington, D. C.) June 1943.

Chemical thermodynamics of hydrocarbons. Frederick D. Rossini. Chapter II of book "The Chemical Background for Engine Research" edited by R. E. Burk and Oliver Crummit, Interscience Publishers (New York, N. Y.) 1943.

The use of the Shore durometer for measuring the hardness of natural and synthetic rubber. Rolla H. Taylor. ASTM Bulletin, No. 123 (Am. Soc. Testing Materials, 260 So. Broad St., Philadelphia, Pa.) p. 25; August 1943.

Measuring the hardness of rubber. (A summary of the preceding article.) Rolla H. Taylor. Rubber Age (250 West 57th St., New York 19, N. Y.) 53, 434 (1943).

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